bentrup

TC 60

Operating Instructions

bentrup

Contents

General Information 1

Security Advice 1

Firing Curves 1

Typical Firing Curves 2

Entering a Firing Curve 2

Checking the Programme Values 3

Programmes 4

Further Hints

Reaction on Power Breakdown 4

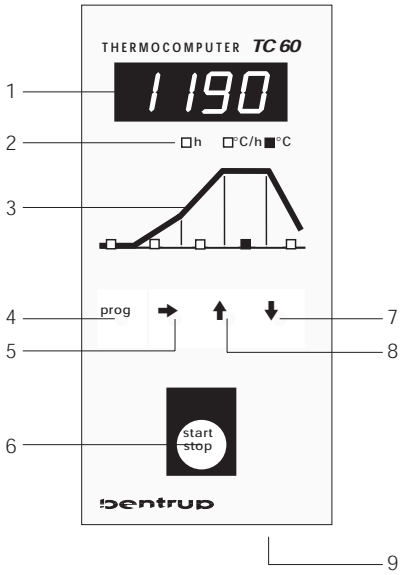
Maximum Values 4

Error Messages 5

Setting the Parameters 6

Technical Information 7

Controller Layout



1	**display**
2	**unit display**
3	**firing curve with indicators**
4	**key for calling up programmes**
5	**key for selecting the segment of the firing curve**
6	**start/stop-key**
7	**key for decreasing the displayed value**
8	**key for increasing the displayed value**
9	**mains switch**

General Information

Your brand new bentrup TC60 represents one of the most flexible kiln controllers of the compact class. The TC60 combines many features, safe and precise kiln operation at a very reasonable price.

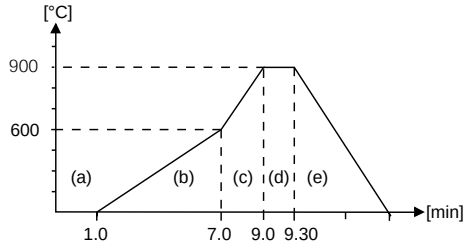
Before operating the TC60, please read and understand the manual carefully. This familiarizes you with all functions of the TC60 quickly and ensures that you can use all the capablities of your control.

Security Advice

Please refer to the security advice of the kiln manufacturer. Make sure that the control is mounted at a safe distance from the kiln and that the control is not exposed to direct heat or radiation when the kiln is opened whilst it is hot.

Firing Curves

The microprocessor controller TC60 provides your kiln with a precise and reproducable controlling unit. The firing course is shown as a firing curve consisting of five segments. An example is shown below. This firing curve consists of the following sements:



a. programme delay (1 hour)
b. heating up to 600°C in 6 hours (100°C/h)
c. heating up to 900°C in 2 hours (150°C/h)
d. dwell (30 minutes)
e. cooling down (350°C/h)

Up to five often used curves can be saved as individual programmes. These firing curves let you consider your experience and special wishes. The values of these five programmes can be changed as you like.

The five programmes are saved even after the controller is powered off. When a firing curve has been entered once, you don´t have to re-enter it every time, you can simply call up this programm. This saves time and avoid errors.

Typical Firing Curves

Depending on application, clay, glaze etc. it required very different firing curves. Your dealer will assist you for detailed questions. Following firing curves are some typical examples (these are loaded as programmes number 1 to 5 in your TC60 as default values):

Firing	to (min)	heat up(°C/h)	temp (°C)	heat up (°C)	final temp (°C)	dwell	cooling (°C/h)
drying	0	30	150	SKIP*	150	0	SKIP
biscuit 800°C	0	100	600	SKIP	800	10	SKIP
biscuit 900°C	0	100	600	SKIP	900	10	SKIP
glaze 1050°C	0	180	400	SKIP	1050	30	SKIP
stoneware 1180°C	0	180	400	SKIP	1180	30	SKIP

**SKIP means maxiumum, ie. uncontrolled heat up / natural cooling resp.*

Entering a Firing Curve

Example: The biscuit firing 800°C (refer to table shown above) is entered as a firing curve as follows:

Power on the controller by the mains switch. After a few seconds the actual kiln temperature appears on the display (1).

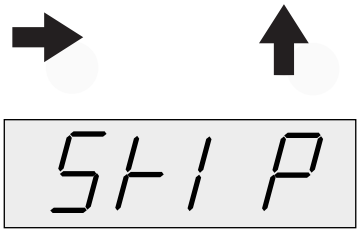
Press the key (5) once. The section (a) of the firing curve (3) lights up. The display (1) shows the actual programme delay as hours / minutes (0.00). Use the keys (7) and (8) to change this value.

The programme delay is used for a delayed start of the firing. This can be used to take advantage of "off peak" electricity (e.g. if you start the programme at 17.00 with a delay time of 5 hours it will cause the firing to commence at 22.00).

Press the key (5) again to step to the next section of the firing curve (b). The display (1) shows the present value for the temperature increase; the unit display (2) reads "degrees centigrade per hour". Use the keys (7) and (8) to set the temperature increase required (in our example 100°C/h).

If you hold the key (7) or (8) pressed, the displayed value will run through automatically.

Press the key (5) and enter the temperature of 600°C using the keys (7) or (8). When the kiln reaches this temperature the TC60 will switch to the next ramp (section c).



Now, press key (5) again to step to section (c) of the firing curve. Adjust the value SKIP by keeping the key (8) pressed until the display shows SKIP.

The value SKIP is shown as depicted on the left. SKIP causes the kiln to heat up with maximum speed (ie. full power) or natural cooling (in a cooling segment).

Enter the values for final temperature, dwell and cooling in the same way: Use the key (5) to step to the next segment and the shown value is adjusted by using the keys (7) or (8) resp.

If you want to change a value again or you have skipped a segment unintentionally, use the key (5) to get back to the beginning of the firing curve. You can alter all values as often as you like.

To start the firing, press the key (6). The display (1) shows from now on always the kiln temperature. During a programme delay, the display (1) shows the remaining time until the firing starts.

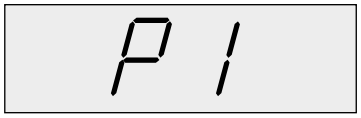
Additionally, the firing curve (3) indicates the current section of the firing. The flashing decimal point in the right hand corner indicates programme running.

Checking the Programme Values

To check or change the values of a programme when the firing has already been started, proceed as follows: Press the key (5), the firing is interrupted automatically (decimal point stops flashing). Now, you can step through the segments using the key (5) as described before. To change a value, use keys (7) and (8). To continue the firing with the new values press key (6) again.

Programmes

prog



A very helpful feature of the TC60 are the five programmes. You can enter the five most often used firing curves so you don´t have to re-enter them for each firing.

Press the key (4): The display (1) shows for a few seconds the presently selected programme number (e.g. "P 1" for programme no. 1). All changes of the firing curve refer to this programme.

Example: To enter the glaze firing 1050°C as programme number 2, proceed as follows:

Press the key (4) multiple times until the display reads "P 2" (for programme 2). After a few seconds the display changes to the final temperature of this programme.

Now, step through the sections of the firing curve as described using the key (5) (refer to the indicators of the firing curve (3)) and enter all values according to the table "glaze firing 1050°C".

By starting the programme (or by selecting any other programme by the key (4)) the actual firing curve will be saved permanently as programme 2.

Of course you can alter the programmes everytime again and the new values will be changed automatically.

Reaction on Power Breakdown

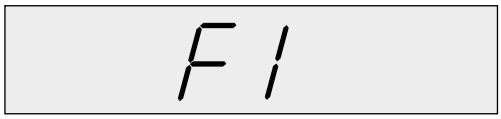
For security reasons the firing will be interrupted if a power breakdown occurs. For special applications a version with power breakdown restart feature is available on request.

Maximum Adjustable Values

programme delay.....0.00 to 10.00 hours
1. heat up .....10°C to 998°C/h, SKIP
1. temperature .....20°C to 1320 °C*
2. heat up .....10°C/h to 998 °C/h, SKIP
final temperature .....20°C to 1320 °C*
dwell .....0.00 to 10.00 hours
cooling .....10 °C/h to 998°C/h,SKIP
** this value varies depending on the kiln*

Error Messages

The integrated microprocessor inside your TC60 performs continous checking of the firing process. In case of any malfunction the display will show an error message pointing to the problem. Following is a description of the possible error messages:



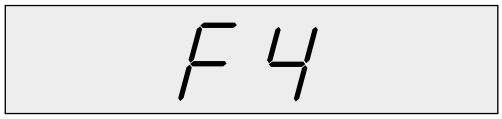
The kiln doesn´t follow the required temperature increase. This error message **points clearly to a kiln problem**. Possible cause:

- broken fuse, power phase or relay failed
- the door (lid) contact is open
- a heating element is broken
- the heating elements are too old (esp.with high firing temperatures)
- the thermocouple has a short circuit

Thermocouple or thermocouple circuit defect

Possible cause:

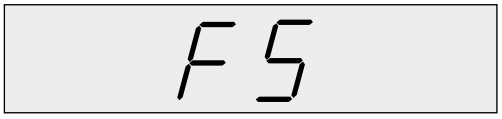
- thermocouple broken
- thermocouple wiring bad
- contacts of the connecting plug bad



Impossible values on data acquisition

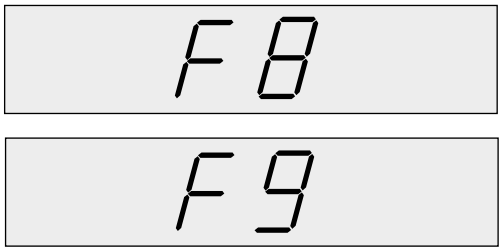
Possible cause:

- thermocouple polarized bad
- thermocouple temperature less than -15°C



Safety Switch Off features was activated

The TC60 has measured an overtemperature in the kiln and switched off the kiln by the 2nd power relay (if fitted). Check carefully the cause before using the kiln again to avoid further damage ! Ask your dealer for assistance.



Error detected during power-up self check

On every power-up the controller performs a self check. If an error is detected the controller shows F8 (ROM error) or F9 (hardware error). Please contact your local dealer.

Setting the Parameters of the TC60

This information describes how to adapt the TC60 to the kiln. Usually, this is done by the kiln manufacturer.

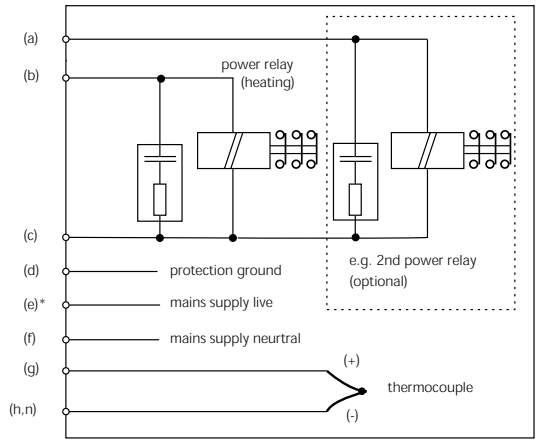
You can call up the parameters to view only; to change them, you need a special authorization code which is available from us on request.

To get into the parameter menu press the key start/stop and hold it pressed for about 4 seconds. Now, the display reads the first configurable value and you can step through the list by pressing the key (5).

code	usage	value range	unit
0	type of thermocouple S-R-K-J	0-3	-
1	max. adjustable temperature	20-1600	°C
2	proportional band	0.0-99.9	%
3	integral time	10-8000	s
4	derivative time	0-999	s
5	cyclus time power relay	1-100	s
6	units for temperatures °C - °F	0-1	-
7	lock error message F1 (heat up check)	0-1	-

Technical Informations

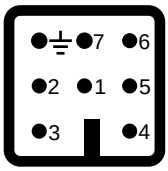
Schematic of a Kiln



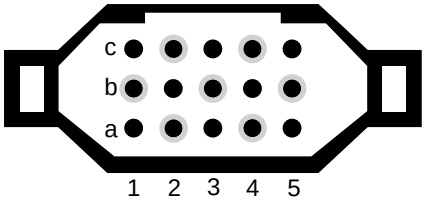
a ... n: electrical links for the controller

Pin Assignment

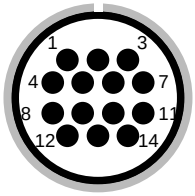
HAN 7 D



HAN 15 D



CPC14



connect.	function	HAN7D	HAN15D	CPC14
a	additional control output (live)	7	C3	12
b	control output power relay (live)	6	A3	14
c	control output power relays (neutral)	1	B3	13
d	protection earth *	⏚	PE clamp	11
e	mains supply live	5	A1	8
f	mains supply neutral	2	B1	9
g	thermocouple +	3	B5	1
h	thermocouple - (type S, R)	4	C5	2
n	thermocouple - (type K, J)	4	A5	3

* protection earth should be connected !

Important Note

Please compare type of thermocouple used in the kiln with the controllers thermocouple input marked on the back of the controller. Mismatch can cause severe damage of kiln and contents